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PART XI

DEPARTMENT OF TRANSPORTATION

Coast Guard

■

BOATS AND ASSOCIATED EQUIPMENT

Safety Standards for Electrical and Gasoline Fuel Systems

Title 33—Navigation and Navigable Waters

CHAPTER I—COAST GUARD, DEPARTMENT OF TRANSPORTATION

[CGD 73-217]

PART 183—BOATS AND ASSOCIATED EQUIPMENT

Safety Standards for Boat Electrical Systems

• *Purpose.* This rule contains minimum safety standards for electrical systems on boats. The purpose of the standards is to reduce the number of deaths and injuries and the amount of property damage on recreational boats caused by fires and explosions of gasoline fuel, gasoline fuel vapors, and other materials. •

BACKGROUND

On October 4, 1976, the Coast Guard published its Proposed Safety Standards for Electrical Systems. Interested persons were invited to submit written data, views or arguments concerning that notice prior to December 1, 1976.

All relevant comments were considered and several changes are included in this rule as a result of these comments. These regulations reflect the best possible accommodation of viewpoints from private citizens, surveyors, insurance companies, testing laboratories and industry.

DISCUSSION OF COMMENTS

The comments received are grouped according to the section to which they relate and are discussed below.

Section 183.401—Purpose, applicability, and effective dates. One commentor inferred that these rules are retroactive. These standards are not retroactive. The standards apply only to boats built after the effective dates of the standards.

Two commentors wanted to extend the effective date of the standards from the proposed 18 months after the date of publication to 24 months after the date of publication. The commentors want more time for electrical component manufacturers to redesign and retool their products. It is felt that there is adequate time for manufacturers to redesign and retool in order to provide electrical components that comply with these standards. In fact, many of the electrical components required in these standards are already available.

Section 183.402—Definitions. One commentor suggested the addition of alternators and auxiliary power plants in the definition of "electrical components." The commentor is concerned that by not specifically including these items in the definition they are excluded by implication. The definition cannot be all inclusive in its list of examples of electrical components to which this rule applies. Alternators and auxiliary power plants are included within the scope of these standards and must comply. Generators are listed in the definition and the term includes propulsion generators and auxiliary power plants. There is no need to add any more items to the definition.

A conflict was noticed when comparing the definition of "sheath" in § 183.402 and the requirements for rigid ducts or conduits in § 183.445(a). The conflict is discussed in the comments for § 183.445 and the definition for "sheath" is changed by the addition of the word "flexible" before the word "tubing".

Section 183.410—Ignition protection. One commentor suggested that electrical components contained within a completely watertight box assembly be excepted from the ignition protection requirements of § 183.410(a). The commentor feels that a watertight box assembly should be considered an electrical control device which is included within the scope of the definition of "electrical component" in § 183.402(c). The scope of § 183.410 allows watertight box assemblies or enclosures to isolate electrical components from gasoline fuel sources. Electrical components isolated from exposure to gasoline fuel sources by a watertight box or other means of isolation do not have to be ignition protected.

Several commentors requested clarification of § 183.410(a). Paragraph 183.410(a) requires electrical components to be ignition protected unless the electrical component is isolated from gasoline fuel sources such as fittings in vent lines, fill lines, and distribution lines. The commentors infer from § 183.410(a) that because a vent line, fill line, or distribution line is inevitably interrupted along its length by a fitting, an electrical component will have to be ignition protected even when the component is exposed to only an uninterrupted section of that vent line, fill line, or distribution line. The implication suggested by the commentors does exist in § 183.410(a), but this implication is not consistent with the intent of the rule. The intent of § 183.410(a) is to require ignition protection only for those electrical components exposed to fittings in vent lines, fill lines, or distribution lines. Section 183.410(a) is revised to properly reflect this intent.

Several commentors are concerned that § 183.410(a) is not specific enough for manufacturers to use as a guide to determine whether or not their electrical components are properly ignition protected and meet the intent of these standards. The commentors suggest that § 183.410(a) be amended to include complete test procedures or adopt by reference present industry test procedures. The inclusion of descriptive test procedures for ignition protection in this standard was considered. This approach requires extensive listing of test procedures for every different electrical component on a boat. Even then, the list cannot be all inclusive, because new electrical components may come on the market after the standards are published. The alternative is to provide a general description of ignition protection requirements to encompass all electrical components which is what § 183.410(a) accomplishes. This regulation sets minimum safety standards for recreational boating. Industry test procedures for ignition protection exceed the minimum levels of safety necessary to promote safe boating. The intent of these regulations is to provide minimum safety standards without being needlessly restrictive. The manufacturer whose product passes accepted industry tests for ignition protection will find that his product meets the requirements of this rule. The commentors' suggestions are rejected.

Some commentors indicate that the requirement in § 183.410(b)(2) that requires a deck to be able to resist a water level of 12 inches without seepage of more than one-quarter fluid ounce of fresh water per hour restricts the design of boat interiors. Further, the commentors suggest that the requirement is not consistent with § 183.410(c) because it requires decks to be more watertight than bulkheads. The intent of § 183.410(b) is to prevent gasoline fuel and fuel vapors from becoming exposed to electrical components that are not ignition protected. Sections 183.410(b)(2) and 183.410(b)(3) address the problems of vertical isolation of gasoline fuel sources from electrical components. It is agreed that § 183.410(b)(2) may be needlessly restrictive when applied to certain boats because the rule requires them to have completely watertight decks. These watertight decks prevent access by the boat operator to machinery and boat equipment normally installed below the deck. A new § 183.410(b)(2) is added to the standard to reflect the intent of § 183.410(b).

Several commentors object to § 183.410(b) because it does not allow a space that is open to the atmosphere, characteristic of open cockpit boats, to act as a means of isolation. In an open boat configuration, where the gasoline fuel sources are in the stern, there is no need to require the electrical components in the dashboard panel to be isolated or ignition protected. The space between the gasoline fuel sources and the electrical components is open to the atmosphere allowing gasoline fuel vapors to quickly dissipate. In response to those comments, therefore, a new § 183.410(b)(3) is added to the standard which allows certain spaces open to the atmosphere to be a means of isolation. Paragraph 183.410(b)(3) permits a minimum open space of 2 feet between the gasoline fuel source and the electrical component. The two foot space must be open to the atmosphere.

Several commentors questioned the apparent inconsistency and impracticability of sealing bulkheads as required by § 183.410(c). Section 183.410(c) requires a bulkhead to extend fully to other structural members with no allowance for gaps or openings between the bulkhead and the structural members to which it is attached. At the same time the section allows a one-quarter inch space around certain items that may pass through the bulkhead. The commentors indicate that in some boat configurations the requirement to seal bulkheads at their extremities is impractical because the location of the bulkhead extremities renders them inaccessible. The objective of § 183.410(c) is to provide bulkheads that prevent non-ignition protected electrical components from becoming exposed to gasoline fuel or gasoline fuel vapors. In some boat

configurations the bulkheads used for isolation have to allow the passage of certain items of equipment that are necessary for the boat to operate properly. These items include control cables, conductors, ducting, piping, and mechanical equipment. Requiring all openings in bulkheads to be sealed is impractical when considering the various boat designs, types of materials, and construction techniques used in the recreational boating industry. Provision has been made for various boat design configurations by allowing a one-quarter inch spacing around certain items that pass through bulkheads that are used for isolation. Allowance for any more unnecessary openings in these bulkheads is unacceptable when the objective of the standard is to limit the passage of gasoline fuel and gasoline fuel vapors.

Two commentors requested clarification of the 12 inch or one-third maximum height measurement required in § 183.410(c)(2). The commentors want to know where the measurement is made on the bulkhead. The commentors also infer from § 183.410(c)(2) that a hatch, door, or access panel in the bulkhead must be watertight along its whole perimeter. The intent of § 183.410(c)(2) is to measure the 12 inches or one-third the maximum height of the bulkhead in a vertical direction from the lowest point of the bulkhead in the boat. Section 183.410(c)(2) is changed and a new § 183410(c)(3) is added to clarify the isolation requirements of catches, doors, or access panels installed in bulkheads. The requirements in § 183.410(c)(2) that apply to a bulkhead apply equally to a hatch, door, or access panel as if it were part of the bulkhead. The requirements in § 183.410(c)(3) that apply to openings in a bulkhead apply to doors, hatches, or access panels as if they are an item passing through an opening in the bulkhead.

Section 183.415—Grounding. One commentor indicated that the grounding requirement in § 183.415 is excessive for boats that have three or more grounded cranking motor circuits. Section 183.415 requires that the common conductor must be large enough in size throughout its length to carry the starting current of the largest cranking motor in the circuit. This requirement is not necessary when three or more grounded cranking motor circuits exist and the starting current of one or more cranking motor circuits is less than the others. The starting current carried by the common conductor when one cranking motor circuit opens would be shared by the other cranking motor circuits, and the amount of current going to each shared circuit would be inversely proportional to the size of the common conductor connected to that shared circuit. For these reasons § 183.415 is changed to require common conductor circuits, instead of a common conductor, to carry the starting current of each of the grounded cranking motor circuits. This change provides consideration for boats that have three or more grounded cranking motor circuits.

Section 183.420—Batteries. Several commentors objected to the one inch restriction for battery movement in § 183.420(a). The commentors feel that the restriction precludes the use of conventional plastic battery boxes because the battery boxes are generally oversized to allow the use of different sized batteries. Oversizing the battery boxes makes it easier to install and remove the battery. Conventional plastic battery boxes are an acceptable approach for securing batteries as long as the manufacturer supports the battery within the box so that it cannot move more than one inch.

Some commentors objected to the test requirements in § 183.420(a). They feel the pulling force and the one minute durations are excessive because some large battery installations use batteries weighing over 100 pounds and the boats carrying these batteries do not experience accelerations represented by the tests in § 183.420(a). In consideration of these comments § 183.420(a) is changed by reducing the pulling force requirement to one that more realistically simulates the forces batteries are exposed to in the marine environment. To provide a more consistent test, § 183.420(a) specifies that the pulling force be applied through the center of gravity of the battery.

Some commentors are concerned with the requirement for shielding fuel lines and fuel system components in § 183.420(c). They feel that the shielding requirements of that paragraph restrict the design of small engine compartments. The commentors suggest that plastic battery boxes be allowed as a means of dielectric shielding. The intent of § 183.420(c) is to prevent the battery terminals from coming in contact with fuel lines or fuel system components when the battery is being installed or removed. Twelve inches provide enough room to safely install and remove the battery without coming in contact with fuel lines and fuel system components. Fuel lines and fuel system components within 12 inches of the battery side surfaces do not present a hazard as do the fuel lines and fuel system components above the battery because the process of installing and removing batteries involves a vertical displacement of the battery. For this reason § 183.420(c) is changed to require only those fuel lines and fuel system components within 12 inches of the battery top surface to dielectrically shielded. As a result of this change to § 183.420(c), the suggestion by the commentors to allow plastic battery boxes to act as the dielectric shield is no longer necessary. A plastic battery top, however, is not an acceptable shield because it is removed when the battery is installed or removed and it therefore, does not provide the protection required by § 183.420(c).

Two commentors suggested that § 183.420(b) apply only to the positive battery terminal instead of both terminals because the negative terminal is already grounded. The commentors' concept is correct, but it is felt that a more general requirement is necessary to eliminate accidental short circuiting of exposed battery terminals. Section 183.420(b) is changed to require that all ungrounded battery terminals be protected.

Several commentors objected to § 183.420(e) because they feel it implies that a means must be provided in the boat to physically collect hydrogen gas discharged by a battery and remove it from the boat. The commentors state that this is excessive when normal engine compartment ventilation can adequately remove the discharged hydrogen gas. The intent of § 183.420(e) is to prevent discharged hydrogen gas from accumulating within the boat to the extent of it becoming an explosion hazard. Section 183.420(e) is changed to prohibit discharged hydrogen gas from accumulating within the boat.

Section 183.425—Conductors: General. One commentor objected to the provision in § 183.425(d) allowing No. 18 AWG conductors to be used on boats. The commentor believes No. 18 AWG conductors are too small because they lack sufficient mechanical strength. The commentor also points out that § 183.425(d) is not consistent with industry standards which require conductors to be at least No. 16 AWG. This standard is intended to provide minimum levels of safety without being needlessly restrictive. No. 18 AWG conductors do not have as much strength as No. 16 AWG conductors. Because of this fact § 183.420(d) permits the use of No. 18 AWG conductors only in bundles with other conductors. The support requirements in § 183.445(a) provide additional mechanical strength for the No. 18 AWG conductors. Mechanical strength is also provided by the terminations of the other conductors and the bundling effect in a sheath by relieving any unusual strains imposed upon the No. 18 AWG conductor. Section 183.425 requires all other conductors installed separately to be at least No. 16 AWG.

One commentor suggested clarification of the intent of § 183.425 because paragraphs (d), (e), and (f) of § 183.425 are not consistent. The commentor states that according to paragraphs (d), (e), and (f) of § 183.425, a No. 18 AWG conductor is allowed to run singly as long as it has a sheath. This is not the intent of § 183.425. To make the intent clear, § 183.425 is changed to permit the use of No. 18 AWG conductors only when they are in a sheath with other conductors.

One commentor questioned whether or not the exception of communication systems in § 183.425(g) includes stereo tape, radio, and record systems. These systems use conductors smaller than No. 18 AWG and are not an identifiable electrical hazard. For this reason the term "communication systems" as used in these regulations includes stereo tape, radio, and record systems.

One comment objected to the exception of navigation equipment in § 183.425(g) because he felt that navigation lights and their associated wiring would be excepted. Section 183.425(g), as well as §§ 183.430, 183.435, 183.445, and 183.450,

exempt electronic navigation equipment, but not other forms of navigation equipment. Accordingly, all the sections in this rule that make exception to navigation equipment are changed to except "electronic" navigation equipment.

It was noticed that § 183.425(b) may be misleading to some manufacturers. It implies that because a conductor may never carry a current greater than that allowed in Table 5 (Table 3 in proposal), the manufacturer would have to oversize his conductors to carry intermittent surge currents normally experienced during start up of electrical components. The intent of § 183.25(b) is to allow conductors to carry continuous currents that do not exceed the amperages allowed in Table 5. An intermittent surge current is not considered to be a continuous current that a conductor normally experiences and does not present a hazardous situation.

Section 183.430—Conductors in circuits of less than 50 volts. Two commentors recommended adoption of a new Society of Automotive Engineers Standard (SAE), J378b dated November 1976, which provides conductor insulating material standards accepted by the boating and electrical conductor industries. This new standard applies to conductors used in circuits of less than 50 volts. The commentors' recommendation has been reviewed and accepted. SAE Standard J378b represents a new development in industry standards for conductors that is acceptable. Section 183.430(a)(2) is changed to reference the insulation temperature rating requirements of SAE Standard J378b dated November 1976, in addition to the requirements of SAE Standards J1127 and J1128 dated November 1975.

One commentor objected to the exception of pigtails of less than seven inches of exposed length from the conductor insulation requirements of § 183.430. The commentor believes that the excepted pigtails are susceptible to damage and could be an electrical hazard. The comment is not accepted. Pigtails of less than seven inches of exposed length are not an identifiable hazard that can adversely affect boating safety.

Section 183.435—Conductors in *circuits of 50 volts or more.* One commentor objected to the reference to Underwriters Laboratories listing in § 183.435(a)(4) because there are other recognized independent testing laboratories that provide the same services as Underwriters Laboratories. Recognized independent testing laboratories have the same opportunity to test products for compliance with these regulations as does Underwriters Laboratories. These independent laboratories also provide listings of acceptable marine products. Section 183.435(a)(4) is changed in response to this comment to allow recognized independent testing laboratories which publish accepted industry listings, and have labeling and followup services, an opportunity to list items that meet the requirements of these regulations.

One commentor requested clarification of § 183.435(b). Paragraph 183.435(b) requires that conductors in circuits of 50 volts or more must have their allowable current carrying capacities reduced when they are bundled together with other similar conductors. The commentor states that these requirements imply that a conductor in a circuit of 50 volts or more must have its current capacity reduced when it is in a duct, bundle, or cable with other conductors regardless of the voltage rating of other conductors. The intent of § 183.435(b) is to reduce the current carrying capacity of conductors in circuits of 50 volts or more if they are in a duct, bundle, or cable with two or more conductors that are also in circuits of 50 volts or more. Paragraph 183.435(b) is changed to properly reflect this intent by rewording the paragraph. Note 2 to Table 5 (Table 3 in proposal) is changed to be consistent with the change to § 183.435(b).

Section 183.445—Conductors: Support and protection. Several commentors opposed the requirement in § 183.445(a) for ducts or conduits to be self draining. The requirement for self draining ducts and conduits provides a means for moisture in ducts and conduits to drain so that conductors in them do not become exposed to excessive moisture. The commentors state that self draining ducts and conduits violate the bulkhead isolation requirements of § 183.410 and that they create a hazard if they drain into junction boxes or onto electrical terminations. The requirement for self draining ducts and conduits has been reconsidered in light of these comments. The conductors required in §§ 183.430 and 183.435 are moisture resistant. Ducts and conduits that carry these moisture resistant conductors are not an identifiable hazard, even if moisture is entrapped in these ducts and conduits. The requirement that ducts and conduits be self-draining is removed from § 183.445(a).

A problem was discovered when the definition of "sheath" in § 183.402 was compared with § 183.445(a) which permits ducts and conduits to support conductors as an alternative to supporting conductors every 18 inches with clamps or straps. The definition of "sheath" in § 183.402(h) includes tubing which manufacturers consider to be a type of conduit. A sheath is not a form of conduit, and, therefore, it must be supported by clamps or straps every 18 inches as required in § 183.445(a). The intent of § 183.445(a) is that ducts and conduits are rigid, they can support conductors, independent of clamps or straps, because they are rigid. Most tubing and other materials used as a sheath are flexible and do not provide support for conductors. To remove the ambiguity the definition of "sheath" in § 183.402(h) has been changed to include flexible tubing. Rigid ducts and conduits are specified in § 183.445(a) as a means of conductor support.

In § 183.445(a) it was discovered that ducts and conduits were not included in the requirement that conductor supports be designed to prevent chafing and damage to conductors. Ducts and conduits are abrasive. Section 183.445(a) is changed to include ducts and conduits in this requirement.

Section 183.450—Conductors: Termination. Two commentors objected to § 183.450(a). They contend that the paragraph is too restrictive because it allows only closed ring, eyelet, or captive spade connectors for terminating conductors. The commentors point out that there are other connectors that meet the intent of the paragraph. The intent of § 183.450 is to require connectors to have a means of mechanical locking that prevents them from coming off the terminal or stud to which they are attached if the nut on the terminal or stud accidentally loosens. For these reasons, and in response to this comment, paragraph 183.450(a) is changed, and a new § 183.450(b) is added to provide additional general requirements that allows the use of other connectors that meet the intent of § 183.450.

One commentor suggested that the scope of § 183.450(f) (§ 183.450(e) in the proposal) be broadened to include the output terminals on alternators. Output terminals on alternators are continuously energized and, as a result, should be protected from short circuiting. The output terminal on alternators should be required to be shielded from accidental short circuiting or meet the requirements of § 183.455 for overcurrent protection. In response to this comment the scope of § 183.450(f) is changed to require all ungrounded terminals or studs that are continuously energized to meet the requirements of § 183.450(f) if they are not protected from overcurrent in accordance with § 183.450(f).

Two commentors suggested that § 183.450(g) (§ 183.450(f) in proposal) be changed to make it clear that the intent of the paragraph is to prevent accidental short circuiting between terminations from different circuits. The commentors indicate that it is a common safe practice for boat manufacturers to intentionally connect two ungrounded current carrying conductors from the same circuit at the same terminal. It is needlessly restrictive to require that the terminations be protected from each other when there is no hazard because they are in the same circuit. In response to these suggestions, § 183.450(g) is changed by specifying that ungrounded terminations from different circuits be protected from accidental short circuiting with each other.

Section 183.455—Overcurrent protec*tion: General.* One commentor proposed a change to § 183.455(e) to except conductors in secondary circuits of ignition systems. The commentor pointed out that conductors in secondary circuits of ignition systems are intentionally ungrounded in order to maintain an arc at the spark plug. Without the arc the engine would not run. Accordingly, overcurrent protection in these conductors would interrupt the arc and prevent the engine from running. It is not the purpose of § 183.455 to require overcurrent protection in secondary circuits of ignition systems. In response to the comment

conductors in secondary circuits of ignition systems are excepted from the requirements of § 183.455.

One commentor suggested the rules include standards for the time/current tripping characteristics of circuit breakers used to meet the requirements of §§ 183.455 and 183.460. The time/current tripping characteristics of a circuit breaker are the characteristics that determine the time that it takes the circuit breaker to open once the current in the circuit exceeds the current for which the breaker is rated. The commentor has a knowledge of the amperages allowed for conductors in the National Electrical the NEC, Table 5 does not require a re- in using low amperage, household type circuit breakers. The commentor's knowledge and experience suggests to him that the amperages allowed in Table 5 for two conductors that are bundled together, which are higher than those allowed in the NEC, combined with the time/current tripping characteristics of low amperage, household type circuit breakers, can result in conductors overheating and causing fires.

Table 5 is based on the standards in the NEC, Table 5 differs from the NEC only in relation to the amperage allowed to be carried by two conductors that are bundled together. The NEC requires a reduced amperage when two or more conductors are bundled together. Unlike the NEC, Table 5 does not require a reduced amperage in the conductors when two conductors are bundled together, but Table 5 does require reduced amperage in each conductor in a bundle of three or more conductors. The amount of reduced amperage required by Table 5 for three or more conductors in a bundle is the same as is required by the NEC for the corresponding number of conductors.

A review of industry data on conductor temperatures when conductors are carrying continuous currents indicates that there is no hazardous temperature rise for the two conductor combination. The time/current tripping characteristics of low amperage, household type circuit breakers is not an identifiable hazardous situation when considering the two conductor combination. The commentor does not provide any supporting data and the Coast Guard has no reported fire and explosion accidents attributed to circuit breakers failing to protect conductors. For these reasons, this rule is not changed in response to the comment.

Section 183.460—Overcurrent protection: Special applications. Some commentors objected to §§ 183.460 (a), (b), and (c) because they appear to violate the intent of § 183.455. The intent of § 183.455 is to protect conductors from overcurrent while §§ 183.460 (a), (b), and (c) are concerned with protecting electrical components from overcurrent.

It is not the intent of these standards to protect electrical components because they have not been identified as a major source of electrical fires due to overcurrent. The comments are accepted. Review of §§ 183.460 (a), (b), and (c) indicates that these paragraphs are inconsistent with § 183.455 and they are not needed. Paragraphs 183.460 (a), (b), and (c) of the proposal are removed from this rule.

One comment objected to § 183.460(d) because it does not require a master switch at the storage battery. The commentor feels the omission of a master switch creates a safety hazard because there is no easy way to disconnect the battery in an emergency. The merits of this comment are being considered and may become the subject of future rulemaking.

One commenter objected to the provision in § 183.460(d) that allows overcurrent protection for a conductor to be located 72 inches away from the battery. The commentor argues that the 72 inches of unprotected conductor can worsen a fire because the insulation could be burned off, exposing the electrically hot conductor. The unprotected hot conductor could then short circuit causing a fire or ignite materials not yet burning. The commentor suggests that the overcurrent protection should be located within 12 inches of the battery to reduce the length of unexposed conductors. This comment is rejected. The safest alternative to eliminating an unprotected conductor is to require an overcurrent protection device on the battery. However, this type of installation is impractical because the inaccessible location of the battery and the possibility of damage to the overcurrent protection device by battery acid vapors. The degree of this hazard was carefully considered during the development of these standards. The 72 inch provision is reasonable, within the scope of these minimum safety standards, and does not adversely affect boating safety.

One commentor objected to § 183.460 (d) and suggested it be deleted because it requires a circuit breaker to be located within the engine room which exposes the circuit breaker to contaminating vapors and condensation that can cause premature failure of the circuit breaker as well as unnecessary nuisance outages. The comment is rejected because premature failure of a circuit breaker overcurrent protection devices and nuisance outages can be prevented by the use of a sealed circuit breaker.

Some commentors wanted clarification of § 183.460(d). They inferred from § 183.460(d) that a circuit breaker can be located more than 72 inches from the battery if the circuit breaker has a switch that disconnects the battery. The commentors feel that requiring a circuit breaker to have a switch restricts the design of circuit breakers and is not consistent with the intent of the paragraph. The intent of § 183.460(d) is to protect ungrounded supply conductors from storage batteries by locating an overcurrent protection device within 72 inches of the battery. Paragraph 183.460(d) does allow the overcurrent protection device to be located more than 72 inches from the battery if the circuit which the device is protecting also has a switch that disconnects the battery. This intent is made clear by deleting the third use of the word "breaker" in § 183.460(d). The switch to disconnect the battery does not have to be a part of the overcurrent protection. As long as the switch that disconnects the battery is in the circuit between the battery and the electrical load, the overcurrent protection can be located more than 72 inches from the battery.

Section 183.465—Conductors: Insulating materials. Two commentors suggested deletion of § 183.465 and Tables 4 and 5 in the proposal, if SAE Standard J378b is adopted in § 183.430 and because the National Electric Code is referenced in § 183.435. The commentors point out that SAE standard J378b, dated November, 1976, and the National Electric Code already specify insulating material standards. The comments are accepted. Review of these standards indicates that § 183.465 can be deleted from these standards without adversely affecting boating safety. Section 183.465 and Tables 4 and 5 are deleted from this rule.

Section 183.470—Caps, boots, and nipples. Several commentors suggested that the test requirements in § 183.470 be deleted because caps, boots, and nipples currently used by the boating and automotive industries are not capable of meeting the requirements of § 183.470. The technical content of § 183.470 was developed from standards used by these industries for testing high voltage conductor insulators made from materials similar to the materials used to make caps, boots, and nipples. There are no accepted industry standards, as such, for caps, boots, and nipples. The commentors indicated that the Society of Automotive Engineers is developing a standard for caps, boots, and nipples. We have reviewed the basic intent of the SAE standard and it is acceptable. The SAE standard, however, will not be completed for several months. For these reasons § 183.470 will be published at a later date.

The Tables in this Subpart I are renumbered because of the renumbering of tables in the preceding subparts of Part 183 and because of the deletion from this rule of proposed Tables 4 and 5.

It was noticed that the headings of §§ 183.435 and 183.460 as they are listed in the table of contents at the beginning of the regulations were not identical to the headings of these sections in the text of the regulations. The headings in the table of contents are changed by correcting the wording so that they are identical with the headings of §§ 183.435 and 183.460 in the text of the regulation.

Standards and Codes

The standards and codes referenced in these regulations have been approved for incorporation by reference by the Director of the Federal Register, and they are on file in the Federal Register Library.

Preparation of Compliance Guideline

Comments were received requesting more detailed definitions and information regarding the intent of many of the sections in this subpart. To the extent that it has been feasible, the regulations have been modified to be more specific. In other instances it has not been possible to change the regulation because a suggested change would impose restric-

tions on a manufacturer which would prohibit him from developing new materials and assembly methods.

The Coast Guard recognizes that a regulation of this magnitude is complex. For that reason a grant was given to the American Boat and Yacht Council, Inc, (ABYC). Under the grant, the ABYC is preparing a compliance guideline for these regulations. The guideline will contain explanatory and interpretive information, illustrations, and diagrams to aid manufacturers in complying with the regulations. The guideline will not prescribe the method a manufacturer must follow to comply with the regulations, but it will be a guide to methods that, if followed, will be accepable to the Coast Guard as meeting the intent and purpose of these rules.

The Coast Guard is working closely with ABYC in the preparation of these guidelines. Attention is being given specifically in areas where public comments indicated that additional information is needed. The guideline will be distributed by the Coast Guard through National Technical Information Service and will be available to the public before this rule is effective.

ECONOMIC IMPACT

This rule has been reviewed for economic effects under Department of Transportation "Policies to Improve Analysis and Review of Regulations" (41 FR 16200). The regulations will result in a cost to industry of approximately $1.275 million to $7.65 million per year. These industry costs will result in an increased cost to the consumer of 0.09 percent to 2.8 percent, depending on the size of the boat purchased. The benefit of the regulations is the reduction in the amount of property damage, the numbers of injuries, and the number of lives lost as a result of fewer gasoline fires and explosions.

Effective date: These rules become effective on August 1, 1977.

Authority: These regulations are adopted under authority of the Federal Boat Safety Act of 1971 (46 U.S.C. 1454). The authority vested in the Secretary of the Department of Transportation by the Act is delegated to the Commandant of the Coast Guard at 49 CFR 1.46(n)(1).

In consideration of the foregoing, Part 183 of Subchapter S of Chapter I, Title 33, Code of Federal Regulations, is amended by adding a new subpart I to read as set forth below.

I have determined that this document does not contain a major proposal requiring preparation of an Inflationary Impact Statement under Executive Order 11821 and OMB Circular A-107.

Dated: January 25, 1977.

O. W. SILER,
Admiral, U.S. Coast Guard Commandant.

Subpart I—Electrical Systems

GENERAL

Sec.
183.401 Purpose, applicability, and effective dates.
183.402 Definitions.
183.405 General.

MANUFACTURER REQUIREMENTS

Sec.
183.410 Ignition protection.
183.415 Grounding.
183.420 Batteries.
183.425 Conductors: general.
183.430 Conductors in circuits of less than than 50 volts.
183.435 Conductors in circuits of 50 volts or more.
183.440 Secondary circuits of ignition systems.
183.445 Conductors: support and protection.
183.450 Conductors: termination.
183.455 Overcurrent protection: general.
183.460 Overcurrent protection: special applications.

AUTHORITY: 46 U.S.C. 1454; 49 CFR 1.46(n)(1).

Subpart I—Electrical Systems

GENERAL

§ 183.401 Purpose, applicability, and effective dates.

(a) This subpart applies to all boats that have gasoline engines for electrical or mechanical power or propulsion, except outboard engines.

(b) The sections in this subpart are effective on the following dates:

August 1, 1977: § 183.401, § 183.405, § 183.420, § 183.445.
February 1, 1978: § 183.415, § 183.425, § 183.430, § 183.435, § 183.440, § 183.450, § 183.455, § 183.460.
August 1, 1978: § 183.410.

§ 183.402 Definitions.

As used in this subpart—(a) "ASTM" means American Society for Testing and Materials. ASTM standards in this subpart may be examined at Coast Guard Headquarters, Room 4314, Trans Point Building, 2100 2nd St., SW., Washington, D.C. 20590 and may be obtained from the American Society for Testing and Materials, 1916 Race Street, Philadelphia, PA 19103.

(b) "AWG" means American Wire Gauge.

(c) "Electrical component" means electrical equipment such as, but not limited to, conductors, solenoids, motors, generators, alternators, distributors, resistors, appliances and electrical control devices.

(d) "IEEE" means Institute of Electrical and Electronic Engineers, Inc. IEEE standards in this subpart may be examined at Coast Guard Headquarters, Room 4314, Trans Point Building, 2100 2nd St., SW., Washington, D.C. 20590 and may be obtained from the Institute of Electrical and Electronic Engineers, Inc., 345 East 47th Street, New York, N.Y. 10017.

(e) "NFPA" means National Fire Protection Association. NFPA standards in this subpart may be examined at Coast Guard Headquarters, Room 4314, Trans Point Building, 2100 2nd St., SW., Washington, D.C. and may be obtained from the National Fire Protection Association, 470 Atlantic Ave., Boston, MA 02110.

(f) "Pigtails" means external power conductors or wires that are part of electrical components and appliances, such as bilge pumps, blowers, lamps, switches, solenoids, and fuses.

(g) "SAE" means Society of Automotive Engineers, Inc. SAE standards in this subpart may be examined at Coast Guard Headquarters, Room 4314, Trans Point Building, 2100 2nd St., SW, Washington, D.C. 20590 and may be obtained from the Society of Automotive Engineers, Inc., 400 Commonwealth Drive, Warrendale, PA 15096.

(h) "Sheath" means a material used as a continuous protective covering, such as electrical tape, molded rubber, molded plastic, or flexible tubing, around one or more insulated conductors.

(i) "UL" means Underwriters Laboratories Inc. UL standards in this subpart may be examined at Coast Guard Headquarters, Room 4314, Trans Point Building, 2100 2nd St., SW, Washington, D.C. 20590 and may be obtained from Underwriters Laboratories Inc., 207 East Ohio Street, Chicago, IL 60611.

§ 183.405 General.

Each electrical component on a boat to which this subpart applies must meet the requirements of this subpart unless the component is part of an outboard engine or part of portable equipment.

MANUFACTURER REQUIREMENTS

§ 183.410 Ignition protection.

(a) Each electrical component must not ignite a propane gas and air mixture that is 4.25 to 5.25 percent propane gas by volume surrounding the electrical component when it is operated at each of its manufacturer rated voltages and current loadings, unless it is isolated from gasoline fuel sources, such as engines, and valves, connections, or other fittings in vent lines, fill lines, distribution lines or on fuel tanks, in accordance with paragraph (b) of this section.

(b) An electrical component is isolated from a gasoline fuel source if—

(1) A bulkhead that meets the requirements of paragraph (c) of this section is between the electrical component and the gasoline fuel source;

(2) The electrical component is—

(i) Lower than the gasoline fuel source and a means is provided to prevent fuel and fuel vapors that may leak from the gasoline fuel source from becoming exposed to the electrical component; or

(ii) Higher than the gasoline fuel source and a deck or other enclosure is between it and the gasoline fuel source; or

(3) The space between the electrical component and the gasoline fuel source is at least two feet and the space is open to the atmosphere.

(c) Each bulkhead required by paragraph (b)(1) of this section must—

(1) Separate the electrical component from the gasoline fuel source and extend both vertically and horizontally the distance of the open space between the fuel source and the ignition source;

(2) Resist a water level that is 12 inches high or one-third of the maximum height of the bulkhead, whichever is less, without seepage of more than one-quarter fluid ounce of fresh water per hour; and

(3) Have no opening located higher than 12 inches or one-third the maximum height of the bulkhead, whichever

is less, unless the opening is used for the passage of conductors, piping, ventilation ducts, mechanical equipment, and similar items, or doors, hatches, and access panels, and the maximum annular space around each item or door, hatch or access panel must not be more than one-quarter inch.

§ 183.415 Grounding.

If a boat has more than one gasoline engine, grounded cranking motor circuits must be connected to each other by a common conductor circuit that can carry the starting current of each of the grounded cranking motor circuits.

§ 183.420 Batteries.

(a) Each installed battery must not move more than one inch in any direction when a pulling force of 90 pounds or twice the battery weight, whichever is less, is applied through the center of gravity of the battery as follows:

(1) Vertically for a duration of one minute.

(2) Horizontally and parallel to the boat's center line for a duration of one minute fore and one minute aft.

(3) Horizontally and perpendicular to the boat's center line for a duration of one minute to starboard and one minute to port.

(b) Each battery must be installed so that metallic objects cannot come in contact with the ungrounded battery terminals.

(c) Each metallic fuel line and fuel system component within 12 inches and above the horizontal plane of the battery top surface as installed must be shielded with dielectric material.

(d) Each battery must not be directly above or below a fuel tank, fuel filter, or fitting in a fuel line.

(e) Hydrogen gas discharged by a battery must not accumulate in the boat.

(f) The positive terminal of each battery must be identified by the letters "POS", or "P", or the symbol "+" marked on the terminal or on the battery case near the terminal.

(g) Each battery terminal connector must not depend on spring tension for its mechanical connection to the terminal.

§ 183.425 Conductors: general.

(a) Each conductor must be insulated, stranded copper.

(b) Except for intermittent surges each conductor must not carry a current greater than that specified in Table 5 for the conductor's gauge and temperature rating.

(c) For conductors in engine spaces, amperages must be corrected by the appropriate correction factor in note 1 of Table 5.

(d) Each conductor in a multiconductor sheath must be at least a No. 18 AWG conductor.

(e) Each conductor installed separately must be at least a No. 16 AWG conductor.

(f) Each No. 18 AWG conductor in a multiconductor sheath may not extend out of the sheath more than 30 inches.

(g) This section does not apply to communication systems; electronic navigation equipment; resistance conductors that control circuit amperage; high voltage secondary conductors and terminations that are in ignition systems; pigtails of less than seven inches of exposed length; and cranking motor conductors.

TABLE 5.—*Allowable amperage of conductors*

Conductor size (AWG)	Temperature rating of conductor insulation						
	60° C (140° F)	75° C (167° F)	80° C (176° F)	90° C (194° F)	105° C (221° F)	125° C (257° F)	200° C (392° F)
18	10	10	15	20	20	25	25
16	15	15	20	25	25	30	35
14	20	20	25	30	35	40	45
12	25	25	35	40	45	50	55
10	40	40	50	55	60	70	70
8	55	65	70	70	80	90	100
6	80	95	100	100	120	125	135
4	105	125	130	135	160	170	180
3	120	145	150	155	180	195	210
2	140	170	175	180	210	225	240
1	165	195	210	210	245	265	280
0	195	230	245	245	285	305	325
00	225	265	285	285	330	355	370
000	260	310	330	330	385	410	430
0000	300	360	385	385	445	475	510

NOTES

1. See the following table:

	60° C (140° F)	75° C (167° F)	80° C (176° F)	90° C (194° F)	105° C (221° F)	125° C (257° F)	200° C (392° F)
Temperature rating of conductor	0.58	0.75	0.78	0.82	0.85	0.89	1.00

2. See the following table:

Number of current carrying conductors:	*Correction factor*
3	0.70
4 to 6	.60
7 to 24	.50
25 and above	.40

§ 183.430 Conductors in circuits of less than 50 volts.

(a) Each conductor in a circuit that has a nominal voltage of less than 50 volts must—

(1) Meet the requirements of § 183.435; or

(2) Meet—

(i) The insulating material temperature rating requirements of SAE Standard J378b dated November 1976; and

(ii) SAE Standard J1127 dated November 1975, or SAE Standard 1128 dated November 1975.

(b) This section does not apply to communication systems; electronic navigation equipment; resistance conductors that control circuit amperage; and pigtails of less than seven inches of exposed length.

§ 183.435 Conductors in circuits of 50 volts or more.

(a) Each conductor in a circuit that has a nominal voltage of 50 volts or more must be—

(1) A conductor that has insulation listed and classified moisture resistant and flame retardant in Article 310, NFPA No. 70–1975, National Electric Code 1975;

(2) A flexible cord type SO, STO, ST, SJO, SJT, or SJTO listed in Article 400, NFPA No. 70–1975, National Electric Code 1975;

(3) A conductor that meets IEEE Std. 45–1971, dated December 3, 1970;

(4) A conductor listed for marine use by an independent testing laboratory which provides listing, labeling, and follow-up service; or

(5) A conductor that meets the mechanical water absorption and flame retardant standards of UL Standard 83, dated July 8, 1976.

(b) Where the nominal circuit voltage of each of three or more current carrying conductors in a duct, bundle, or cable is 50 volts or more, the amperages of each of those conductors must not exceed the value in Table 5 multiplied by the correction factor in note 2 to Table 5 for the number of conductors that carry 50 volts or more.

(c) This section does not apply to communication systems; electronic navigation equipment; resistance conductors that control circuit amperage conductors in secondary circuits of ignition systems; and pigtails of less than seven inches of exposed length.

§ 183.440 Secondary circuits of ignition systems.

(a) Each conductor in a secondary circuit of an ignition system must meet SAE Standard J557, dated January, 1968.

(b) The connection of each ignition conductor to a spark plug, coil, or distributor must have a tight fitting cap, boot, or nipple.

§ 183.445 Conductors: support and protection.

(a) Each conductor or group of conductors must be supported by clamps or straps not more than 18 inches apart unless the conductor or group of conductors is enclosed in a rigid duct or conduit. The clamps, straps, ducts, or conduits must be designed to prevent chafing or damage to the conductor insulation.

(b) If a conductor or group of conductors connected between two components that can move in relation to each other, each conductor or group of con-

ductors must have a loop, slack, or other strain relief.

(c) Each conductor or group of conductors that passes through a bulkhead, structural member, junction box, or other rigid surface must be protected from abrasion.

(d) This section does not apply to communications systems; electronic navigation equipment; and high voltage secondary conductors and terminations in the ignition system.

§ 183.450 Conductors: termination.

(a) Each connection to a screw terminal or stud that is outside of a junction box or enclosure must be connected by a closed ring connector, eyelet connector, captive spade connector, mechanical locking connector, or spring locking connector.

(b) Each stripped conductor connected to a compression screw terminal that is outside a junction box or enclosure must be secured mechanically to provide strain relief for the stripped conductor connection.

(c) Each single friction connector, spring type connector, and multi-connector plug that is outside of a junction box or enclosure must not separate if subjected to a six pound tensile force along the axial direction of the connector for one minute.

(d) A soldered connection must not be the sole means of connection between two or more conductors or between a conductor and a connector, except a conductor may be soldered to a connector that joins the conductor to a battery terminal or stud, if the length of the soldered joint is at least 1.5 times the diameter of the stranded portion of the battery conductor.

(e) Each connection that is outside of a junction box and that is used to join conductors to each other or that is used to join a conductor to a connector must not break when subjected for 10 minutes to a tensile force shown in Table 6 for the smallest conductor size in the connection.

(f) Each ungrounded terminal or stud that is continuously energized must meet § 183.455 or must have a boot, nipple, cap, cover, or shield that prevents accidental short-circuiting at the terminals or studs.

(g) Each termination composed of an ungrounded current carrying conductor, terminal fitting, and connector must be protected from accidental short circuiting with—

(1) Another termination from another circuit composed of an ungrounded current carrying conductor, terminal fitting, and connector; or

(2) Any metal that is grounded.

(h) A conductor must not be joined to another conductor by a wire nut or wire screw.

(i) This section does not apply to communication systems and electronic navigation equipment.

§ 183.455 Overcurrent protection: general.

(a) Each ungrounded current-carrying conductor must be protected by a manually reset, tripfree circuit breaker or fuse.

(b) A manually reset, tripfree circuit breaker or fuse must be—

(1) At the source of power for each conductor;

(2) At the point where the conductor size is reduced to a smaller gauge; or

(3) At the origin of a circuit, if the circuit breaker or fuse has a current rating that prevents overloading of the smallest conductor in the circuit.

(c) The current rating of each circuit breaker or fuse must not exceed—

(1) For circuits of less than 50 volts, 150% of the value of the amperage in Table 5 for the conductor size it is protecting; and

(2) For circuits of 50 volts or more, the value of the amperage in Table 5 for the conductor size it is protecting. If this value does not correspond to a standard size or rated circuit breaker or fuse the next larger size or rated circuit breaker or fuse may be used if it does not exceed 150% of the allowed current capacity of the conductor.

(d) The voltage rating of each circuit breaker or fuse must not be less than the nominal circuit voltage of the circuit it is protecting.

(e) This section does not apply to resistance conductors that control circuit amperage; conductors in secondary circuits of ignition systems; pigtails of less than seven inches of exposed length; and power supply conductors in cranking motor circuits.

TABLE 6.—TENSILE TEST VALUES FOR CONDUCTOR SPLICES

(CONDUCTOR-CONDUCTOR AND CONDUCTOR-CONNECTOR JOINTS)

Wire size (AWG):	*Tensile force pounds*
18	10
16	15
14	30
12	35
10	40
8	45
6	50
5	60
4	70
3	80
2	90
1	100
0	125
00	150
000	175
0000	225

§ 183.460 Overcurrent protection: special applications.

(a) Each ungrounded supply conductor from a storage battery must have a manually reset, tripfree circuit breaker or fuse, unless the supply conductor is in the main power feed circuit from the battery to an engine cranking motor. The circuit breaker or fuse must be within 72 inches of the battery measured along the conductor, unless the circuit has a switch that disconnects the battery.

(b) Each ungrounded output conductor from an alternator or generator, except for self-limiting alternators or generators, must have a circuit breaker or fuse that has a current rating that does not exceed 120 percent of the maximum rated current of the alternator or generator at 60° C.

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CGD 74-209)

PART 183—BOATS AND ASSOCIATED EQUIPMENT

Safety Standards for Boat Gasoline Fuel Systems

• *Purpose.* This rule contains minimum safety standards for fuel systems on boats. The purpose of the rule is to reduce the number of deaths and injuries and the amount of property damage caused by fires and explosions of gasoline on boats. •

BACKGROUND

On September 30, 1976, the Coast Guard published its Proposed Safety Standards for Boat Gasoline Fuel Systems. Interested persons were invited to submit written data, views, or arguments concerning that notice prior to December 1, 1976.

All relevant comments were considered and several changes are made to the rule as a result of the comments. These regulations reflect the best possible accommodation of viewpoints from industry, surveyors, insurance companies, testing laboratories and private citizens.

DISCUSSION OF COMMENTS

The comments received are grouped according to the section to which they relate and are discussed below.

Section 183.501—Applicability. One commentor on § 183.501 requested that more time be granted before compliance is required with §§ 183.542 and 183.568. Section 183.582 deals with pressure tests for fuel systems and § 183.568 contains requirements for anti-siphon protection. The commentor requested the additional time because of possible tooling changes that may be necessary to comply with § 183.582 and because of the unavailability of the anti-siphon valves required by § 183.568. This comment is not accepted. The anti-siphon valves required by § 183.568 are commercially available, allowing boats to comply with this section immediately. Section 183.582(e) is, however, modified by excepting from the required examination each connection at fill and vent fittings. This modification of the rule eliminates the need for tooling changes.

One commentor requested that inboard boats with open engine installations be exempted from this rule because outboard engines are exempted. This comment is rejected. Even if the absence of an engine cover reduces fuel vapors, fuel leaks still occur, allowing fuel to leak into the boat where it can be ignited by electrical devices or other sources of ignition in the boat. Boats with outboard engines are exempted from these rules because outboard boats have a significantly lower rate of accidents involving fires and explosions of fuel.

One comment from an industry association suggested that outboard boats that have permanent fuel tanks be cov-

ered by these rules because these fuel tank installations are similar to those on inboard boats. This comment is rejected because present statistics show that the accident rate is too low, when compared with the cost of compliance, to warrant the inclusion of outboard boats.

Section 183.505—Definitions. One commentor pointed out that the specification for the fuel hoses in § 183.505 is too vague because it refers only to SAE Standard J30B. The SAE Standard J30B describes four different types of hoses, and specifies different test criteria for each application to which the hose is subjected. Specifically the commentor suggests that the fuel line should be specified SAE J30RI, one of the four types of hose in the SAE Standard. This comment is not accepted because it would prohibit the use of the other types of hoses which are specified in SAE J30B.

One commentor claimed that the description of the "USCG Type A Hose" and "USCG Type B Hose" in § 183.505 does not clearly state to what extent the SAE Standard has to be followed. The proposed § 183.505 was worded in such a way to require compliance with both the performance requirements and the construction dimensions of the SAE Standard. In response to this comment the word "performance" is added to the description to clarify that the requirement is to comply only with the performance requirements of the SAE Standard.

One commentor pointed out that the proposed rule also referred to a SAE J30B standard dated August 1973. The SAE J30B standard was recently replaced by SAE J30C, dated March 1976. The reference in § 183.505 to the SAE J30B has been changed to require compliance with the SAE J30C. Because Military Specification MIL P-2192913 is added to § 183.516(a)(2), a definition of the term "Military Specification" and a statement of the specification's availability are added to § 183.505.

Section 183.510—Fuel tanks. One commentor objected to the requirement in § 183.510 for mechanical testing of fuel tanks and proposed that these tests be deleted because tanks can be built sufficiently strong without the need to perform costly tests on them to determine their actual strength. This comment is rejected because mechanical tests are necessary to determine if a tank can survive the physical stresses encountered in the marine environment.

Several comments were received requesting the deletion of §§ 183.510 (d)(1) and (e)(1). Paragraphs 183.510 (d)(1) and (e)(1) require fuel tanks with a capacity of 25 gallons or more to be shock tested under § 183.584. The commentors argued that the shock test is not realistic because it simulates conditions that are more severe than the conditions that boats encounter in normal use. This comment is accepted because tests have shown that the proposed test does not simulate actual conditions. For this reason the requirement that tanks with capacities of 25 gallons or more be shock tested has been removed from §§ 183.510 (d) and (e)(1).

Section 183.512—Fuel tanks: prohibited materials. Two commentors asked that § 183.512 be changed to require that materials used for fuel tanks be of a specified thickness and alloy because some industry standards include those specifications. This request is rejected, because as long as the tank meets the tests for mechanical strength in § 183.510 there is no need to specify material and tank thickness.

One commentor objected to allowing metal tanks to be foamed in place. He argued that moisture can collect between the metal and the foam, causing the tank to corrode. The comment is rejected. The risk of moisture collecting between the tank and the foam, causing corrosion of the tank, is reduced by restrictions on the type of materials that can be used to construct the tank and by restrictions on the type of bond that must exist between the tank surface and the foam.

Section 183.514—Fuel tanks: labels. One commentor suggested that § 183.514 should require the tank label to be placed on the tank where it can be easily inspected. The comment is rejected because a tank manufacturer cannot know which, if any, surface on the tank will be visible once the tank is installed.

Another commentor pointed out that § 183.514(b)(6), which requires the fuel tank label to include shock test classification in "g's," if applicable, be deleted as because the requirement is redundant in light of § 183.514(b)(8), which requires that a tank be installed in a location determined by the "g" load for which it has been tested. This comment is accepted. Section 183.514(b)(6) is removed and the subsequent paragraphs are renumbered.

Section 183.516—Cellular plastic used to encase fuel tanks. Some commentors objected to the requirement in § 183.516 that requires the use of polyurethane foam with a minimum density of 3.2 pounds per cubic foot. These commentors suggested the use of foam with a density of two pounds per cubic foot for encasing metal fuel tanks. The commentor claimed that two pounds density foam is sufficiently strong for encasing fuel tanks. The merits of these comments have been carefully reviewed and are rejected. The heavier density foam is needed for adequate compression strength and minimum water absorption.

One commentor suggested that ASTM Specification C-272 in § 183.516(b) of the proposal be replaced by Military Specification MIL P-21929B, a standard that is widely used by the boating industry and the military. Like the Military Specification, the ASTM Specification sets a limit on the amount of water that can be absorbed by cellular plastic foam. Most cellular plastic foams manufactured today, the commentor pointed out, absorb more water than is allowed to be absorbed under the ATSM standard. All of these foams, however, are able to meet the water absorption requirements of Military Specification MIL P-21929B. Because this rule sets only minimum acceptable safety standards for boats and because the Military Specification is an acceptable standard for marine use, it is substituted for the ASTM standard that appeared in proposed § 183.516(b). Proposed § 183.516(b) appears as § 183.516(a)(2) in this rule.

The density specification for polyurethane foam in proposed § 183.516(d) was incorrectly specified as 3.6 pounds per cubic foot. The density specification is corrected to 3.2 pounds per cubic foot.

One commentor pointed out that the proposed rule required cellular plastic to meet two different requirements: one for compressive strength, and one for a minimum density, because the word "and" was placed between the two requirements in the proposed rule. The commentor claimed that no cellular plastic meets both requirements. He suggested that the regulations should be changed to specify that only one of the requirements has to be met. This suggestion is accepted. It has been determined that cellular plastic used to encase metallic fuel tanks is acceptable as long as it meets either the requirement for compressive strength or the requirement for a minimum density for polyurethane foam. To make this determination clear an editorial change is made by rearranging the order of the paragraphs in § 183.516.

Section 183.520—Fuel tank systems. One commentor suggested that the heading of § 183.520 be changed from "Fuel tank vents" to "Fuel tank systems", to indicate that the vents are not part of the fuel tank, but instead are part of the fuel tank system. This suggestion is accepted because ventilation of the fuel tank is achieved through a system of components such as hoses and fittings. The word "system" is added after the word "vent" in the phrase "each fuel tank must have a vent * * *" in § 183.520 (a) for the same reason. Based on this comment, the word "system" is also added to the heading of § 183.552 for this same reason.

One commentor wanted to know why § 183.522(a) prohibits fuel from blowing back through the fill fitting when a tank is between one-fourth and three-fourths full. Fuel blowback can occur before a steady flow of fuel has started to pour into a tank that is about one-fourth full or when, during refueling, the fuel in the tank reaches the three-fourth full level and begins to surge along the inside top surface of the tank. Fuel that is blown back through the fill fitting may enter the boat and come in contact with a source of ignition and cause a fire or explosion.

Some commentors claimed that a flow rate for filling a fuel tank at nine gallons per minute, required by § 183.522 (b), is too high and should be lowered. This suggestion is not accepted because a flow rate of nine gallons per minute approximates the actual flow from a gasoline pump nozzle when it is used to fill the fuel tank in a boat. Unless the fuel tank, in combination with the fill and vent hoses, is capable of being filled up at a rate of at least nine gallons per minute, an overflow of gasoline is likely to occur. Another commentor suggested that the flow rate be changed to "at a

prudent rate". This suggestion is also rejected because a flow rate must be specified so a test can be conducted to determine compliance with this requirement.

Section 183.524—Fuel pumps. One commentor suggested that the materials used for fuel pumps be specified because of the chance that some materials might melt in a fire. This proposal is not accepted; the fire test requirement in § 183.590 assures that the material used for fuel pumps is durable enough to withstand a fire of at least 2½ minutes in duration. In this time period persons in the boat can notice the first and extinguish it before it spreads.

Section 183.526—Carburetors. Several commentors wanted to know if "leakage" as used in § 183.526(a) includes internal leaks within a carburetor. As used in the regulation, the word "leaks" means to leak externally from the carburetor into the boat. Any flow of fuel from the carburetor to the engine is internal and does not constitute a leak. The words "must meet the requirements of paragraph (b) of this section" are added to § 183.526(a) to specify how the presence of a leak is determined after the fire test under § 183.590 is conducted.

One commentor pointed out that under the regulation twin carburetors could leak ten cubic centimeters of fuel into an engine compartment and still comply with this regulation. This amount of leakage is acceptable; there still is a safety margin before the fuel vapors in an engine compartment reach an explosive level.

One commentor asked if carburetors that have been modified using racing kits have to be in compliance. The manufacturer of the boat is responsible for the modified carburetor meeting the requirements of this section if he installs or furnishes the kit. Modifications performed by the boat owner are not subject to this regulation.

Section 183.528—Fuel stop valves. One commentor suggested that § 183.528 require an expansion valve in the fuel line, if a fuel line has a closed stop valve in each end. An expansion valve eliminates the risk of the fuel line rupturing by relieving the pressure build-up in the fuel line if fuel expands due to temperature increases. This suggestion is not accepted because this type of failure has not shown up in accident statistics.

Section 183.530—Spud, pipe, and hose fitting configuration. One commentor suggested that fill lines should meet the requirements in § 183.530. Section 183.530 requires each spud, pipe, or hose fitting used with hose clamps, except those used for a fuel fill line, to have a bead, flare, or a series of grooves or separations to prevent the connection from coming loose. The commentor believes that vibrations in the boat might cause the hose to come off a fill fitting spud that does not have a bead or grooves. The rule is not changed in response to this comment. The fill fittings are excepted from § 183.530 because the relatively stiff fill hose is hard to properly install over a spud with a bead and improper installation might result in a fuel leak. Moreover, the requirement that two clamps be used for installing fill hoses ensures a secure connection without need for a bead or grooves on the spud.

Section 183.532—Clips, straps, and hose clamps. Some commentors suggested that the word "nominal" be included where the proposed § 183.532(c) and Table 7 specified "minimum band width" because the band widths of mass produced clamps are narrower than the widths specified in Table 7 due to manufacturing tolerances. For this reason the regulation is changed by adding the word "nominal" to § 183.532(c) and to the heading of Table 7.

One commentor said that § 183.532(c) restricts the design of fuel line connections by requiring the use of hose clamps which have a minimum band width that is contingent on the outside diameter of the hose to which it is attached. The commentor suggested that, as an alternative to specifying minimum band widths for clamps, the Commandant should develop a performance standard for hose clamps that would specify how tightly a clamp must be fastened to a hose. This comment is rejected because a performance standard would require a manufacturer to conduct a complicated test to determine clamp tightness. The use of Table 7 is an advantage over the commentor's suggestion because it is an easy method of determining the size of clamp to use that experience shows will ensure a secure connection between the hose and fuel line without having to test the tightness of the connection.

Section 183.536—Seals and gaskets in fuel filters and strainers. One commentor suggested that ASTM D-471 Reference Fuel C be specified in § 183.536(b) instead of a gasoline that has at least 50 percent aromatic content. The reason for this suggestion is that ASTM Reference Fuel C has a 50 percent aromatic content and is readily available. This suggestion is rejected because the aromatic content of fuel is the characteristic that deteriorates seals and gaskets. The other characteristics in ASTM D-471 Reference Fuel C are not necessary for the purpose of § 183.536.

Another commentor suggested that the requirements for gaskets in § 183.536 should also apply to gaskets in fuel gauges installed on fuel tanks. These gaskets are exposed to fuel and are, therefore, subject to deterioration. This comment is rejected. Because fuel gauge gaskets are located above the normal level of fuel in a tank, they are not constantly exposed to liquid fuel, and, because of this fact, there is little chance of their deterioration. Gaskets in fuel filters and strainers, on the other hand, are constantly exposed to the deteriorating effects of liquid fuel.

Section 183.538—Metallic fuel line materials. One commentor suggested that the word "metallic" be included in the heading of § 183.538 to clarify that this section does not apply to rubber fuel hoses. This suggestion is adopted.

Another commentor suggested that the minimum wall thickness specification of 0.029 inches in § 183.538(b) be replaced with a performance test in view of the different physical properties of the materials specified. This suggestion is rejected because its adoption would make it necessary for a boat manufacturer to perform costly tests to determine the strength and corrosion resistance of fuel line materials. Experience has shown that the use of the specified materials at the specified thickness ensures a safe fuel line.

One commentor wanted to know if stainless steel braided teflon covered aircraft hose is considered metallic fuel hose. Teflon covered hose is not considered metallic because the teflon is the material that comes in contact with fuel. Thus, teflon covered hose must meet the requirements for USCG Type A or B hoses.

Section 183.540—Hoses: identification. One commentor pointed out an error in § 183.540(d). In the proposal, the paragraph said that the marking on the hose must be "at no less than 12 inch intervals." This wording allows any spacing above 12 inches. The paragraph should have restricted the spacing to 12 inches or less. Paragraph 183.540(d) is modified by substituting the words "at intervals of 12 inches or less" for the words "at no less than 12 inch intervals."

Section 183.550—Fuel tanks: installation. One commentor pointed out that in the proposal § 183.550(g) specified that cellular plastic used to encase nonmetallic fuel tanks is required to meet two different requirements: one for compressive strength, and one for a minimum density. The proposed rule was in error because cellular plastic used to encase non-metallic fuel tanks is acceptable as long as it meets either the requirement for compressive strength or the requirement for a minimum density for polyurethane foam. An editorial change is made to § 183.550(g) by substituting the phrase "§ 183.516 (b) or (c)" for the phrase "§ 183.516 (a) and (d)."

A commentor asked what part of the tank must be aft of the boat's half length. Paragraph 183.550(h) of the proposal specified where fuel tanks must be installed in relation to the boat's half length. Paragraph 183.550(h) did not specify what part of the tank should be used as reference when installing the tanks in the boat. The intent of paragraph § 183.550(h) is that the tank should be located with its center of gravity either forward or aft of the boat's half length, depending on the shock test to which the tank was subjected. A tank rated for a shock of less than 25 g's can only be installed in the aft half of the boat, where the pounding from waves is less severe than in the forward half of the boat. These tanks are labeled under § 183.514(b)(8) with the words, "Must be installed aft of the boat's half length."

The words "installed with its center of gravity" are added to § 183.550(h) to clarify this intent so the paragraph now reads as follows:

"Each fuel tank labeled under § 183.514(b)(8) for installation aft of the boat's half length must be installed with its center of gravity aft of the boat's half length."

Section 183.556—Plugs and fittings. One commentor suggested that § 183.556(b) be amended to require the use of a non-corrosive material for the construction of plugs used to service the fuel filter or strainer. This suggestion is rejected because the materials presently used for plugs do not corrode enough to cause leaks in the fuel system.

Section 183.558—Hoses and connections. One commentor pointed out a typographical error in Table 8. The dimension 0.020 inch had incorrectly been printed 0.29 inch. The error is corrected in Table 8.

Several commentors proposed that USCG Type B hose be allowed only on boats 26 feet in length or less. They cited that a fire in boats over 26 feet can go undetected for 2½ or more minutes and for this reason all hoses on these boats should be USCG Type A, the type of hose that is required to meet the fire test in § 183.590. This suggestion is rejected because the Coast Guard does not have accident statistics that would indicate a need for requiring boats over 26 feet to use only fire resistant hose. A long fuel hose which might be used in a boat over 26 feet might not be readily accessible in case of a fire, but that hose, because of its length, would contain more than five ounces of fuel and thus it is required to be fire proof. A short hose which contains less than five ounces of fuel, and thus does not have to be fire resistant, would be installed close to the engine and thus is readily accessible to a fire extinguisher in case of a fire.

Section 183.564—Fuel tank fill system. Several commentors claimed that the gasoline overflow rate standard in § 183.564(a) is excessive because no time period is specified for the duration of the overflow. Paragraph 183.564(a) requires a tank's fuel fill opening to be in a place where a gasoline overflow at the rate of five gallons per minute will not enter the boat. An overflow might occur during refueling when the fuel tank becomes full, but fuel continues to be pumped through the fuel fill nozzle into the tank. When this situation occurs, the fuel is blown back into the nozzle which causes the nozzle to automatically shut off the flow of fuel, thus limiting the amount of fuel that actually overflows. The amount of fuel that overflows depends on the rate that the fuel is pumped into the tank and the period of time that it takes for the nozzle to shut off and be removed from the fill opening once an overflow begins. Because no time period was stated in the proposed § 183.564(a), the commentors felt that an unlimited and undeterminable amount of fuel might be allowed to overflow during compliance testing. For this reason, the standard, as proposed, did not duplicate the actual conditions it was designed to protect against. In response to the comment, therefore, a time period of five seconds has been added to the standard. Five seconds is considered adequate for the purpose of approximating the time it takes a fuel pump nozzle to shut off and be removed from the fill opening once fuel begins to overflow from a full fuel tank.

Another commentor objected to the requirement of having to use two hose clamps in § 183.564(b)(3) instead of one, because a second clamp, incorrectly installed, can cut the fuel line causing a leak. The proposed regulation is not changed in response to this comment. Two clamps are required to ensure that the relatively stiff hose will not slide off the fitting or twist into a position that would cause a fuel leak. If a hose is cut because of an improperly installed clamp a leak can occur whether one or two clamps are used.

Two commentors recommended that the word "nominal" be added immediately before the words "band width" in § 183.564(d)(1) because band clamps, due to manufacturing tolerances are narrower than the widths specified in the rule. This recommendation is accepted for the reason given by the commentors.

Section 183.566—Fuel pump: placement. One commentor suggested that all fuel pumps should be mounted on the engine to reduce the risk of vibration causing a rupture in a fuel line connection between the fuel pump and the engine. The commentor, therefore, suggested that the phrase "or within 12 inches of the engine" be deleted from § 183.566. This suggestion is rejected. A fuel leak occurs where the fuel line is connected to the engine or fuel pump, and whether the pump is mounted on the engine or not does not change the chances of leaks; in each case the hose is subjected to the same amount of vibration.

Section 183.568—Anti-siphon protection. One commentor suggested that anti-siphon valves be required to pass the fire test under § 183.590 because the other components in the fuel system are required to pass the test. This comment is rejected. If a fuel stop valve fails in a fire, air is induced into the valve. This process has the effect of preventing siphoning of fuel from the fuel tank. The other components in the fuel system are required to meet the fire test, because if any of them fail, fuel would leak out of them and feed the fire.

Some other commentors requested the deletion of the requirement that electrically operated fuel stop valves and anti-siphon valves be mounted at the fuel tank withdrawal fitting. The commentors suggested this change because it would allow a fuel filter to be placed in the fuel line between the tank and valve. This filter would prevent dirt in the fuel from reaching the valves and interfere with their function. This reasoning is accepted and § 183.568 is changed to allow the valves to be installed away from the tank if the valve and fuel line are mounted higher than the top of the tank. By mounting the fuel line higher than the top of the tank, fuel runs back into the tank, instead of running out of the fuel line, if the line is severed.

Section 183.582—Static pressure test for fuel systems. Some commentors requested that carburetors not be included in the pressure test under § 183.582(a) because the carburetor can not be pressurized without pressurizing the engine. This comment is accepted. The intent of the pressure test is to ensure that the fuel system, excluding the carburetor and engine, does not leak fuel. Paragraph 183.582(a) is modified to indicate that only that portion of the fuel system that is between the carburetor and the fill and vent fittings on the boat is pressure tested.

Several commentors questioned the requirement in § 183.582(e) for examination of all connections after the static pressure test. These commentors pointed out the difficulty in visually inspecting for possible leaks the fill and vent fittings below a boat deck and suggested that this requirement be deleted. This suggestion is adopted. Because they are at the highest point in the fuel system, fuel hoses at the deck fittings normally do not contain any fuel which can leak into the boat. Section 183.582(e) is modified by excepting each connection between the fill and vent fitting and the line at the deck or hull from the examination required under § 183.582(e).

Section 183.584—Shock test. One commentor pointed out that the requirement in § 183.584 to cap and seal each opening in the tank should be omitted because if these openings are capped there is no outlet for pressure that may build up due to changes in the water temperature. Without openings in the tank, excessive pressure can build up, causing the tank to fail structurally. For this reason, this comment is accepted and § 183.584(e) of the proposal is deleted and the subsequent paragraphs are renumbered.

Several commentors suggested that the shock test under § 183.584 for tanks with a capacity of 25 gallons or more does not simulate actual boating conditions and should be deleted or modified. The duration of the shock between 35 and 45 milliseconds was claimed to be especially severe. This reasoning is accepted and the reference to the alternative testing for tanks 25 gallons or more is deleted from § 183.584(e) (1) and (2). The tests required under §§ 183.586 and 183.588 are sufficient to ensure that fuel tanks with a capacity of 25 gallons or more are strong enough to withstand actual usage in boats.

Two commentors suggested that § 183.584(f), which requires each vertical acceleration pulse to approximate a half sine wave, be omitted because a half sine wave is neither definable nor reasonably achievable. The shock test ensures that the tank can withstand actual boating conditions without the need of specifying the shape of the shock wave. The requirement to approximate a half sine

wave for the shock would have imposed unnecessary cost on the tank manufacturers because of the sophisticated equipment that would have been required to perform the test. For these reasons the commentors suggestion is accepted and the requirement is removed.

Section 183.588—Slosh test. Some commentors pointed out that § 183.588(c) of the proposal, which requires preconditioning the tank in fuel for 30 days prior to testing, is redundant because the preconditioning has already taken place under § 183.586 and should not have to be repeated. This is correct, § 183.588(c) is deleted and the subsequent paragraphs are renumbered.

Section 183.590—Fire test. Several commentors requested that regular pump gasoline, because of its lower cost, be allowed as an alternative to the use of heptane in the fire test under § 183.590. This comment is rejected because regular pump gasoline produces a different temperature than heptane produces. Unless heptane is used in the test, a manufacturer can not be certain that his product meets the temperature requirement of this rule.

PREPARATION OF COMPLIANCE GUIDELINES

Several comments were received requesting more detailed definitions and test procedures on many of the sections in this subpart. To the extent that it has been feasible, the regulations have been modified to be more specific. In other instances it has not been possible to change the regulation because a suggested change would impose restrictions on a manufacturer which would prohibit him from developing new materials and assembly methods.

The Coast Guard recognizes that a regulation of this magnitude is complex. For that reason a grant was given to the American Boat and Yacht Council, Inc. (ABYC). Under the grant, the ABYC is preparing a compliance guideline for these regulations. The guideline will contain explanatory and interpretative information, illustrations, and diagrams to aid manufacturers in complying with the regulations. The guideline will not prescribe the method a manufacturer must follow to comply with the regulations, but it will be a guide to methods that, if followed, will be acceptable to the Coast Guard as meeting the intent and purpose of these rules.

The Coast Guard is working closely with ABYC in the preparation of the guideline. Attention is being given specifically in areas where public comments indicated that additional information is needed. The guideline will be distributed by the Coast Guard through the National Technical Information Service and will be available to the public at cost before this rule is effective.

STANDARDS AND CODES

The standards and codes referenced in these regulations have been approved for incorporation by reference by the Director of the FEDERAL REGISTER and they are on file in the Federal Register Library.

ECONOMIC IMPACT

This rule has been reviewed for economic effects under Department of Transportation "Policies to Improve Analysis and Review of Regulations" (41 FR 16200). The regulations will result in a cost to industry of approximately $2.75 million to $9.35 million per year. These industry costs will result in an increased cost to the consumer of .16 percent to 3.3 percent, depending on the size of boat purchased. The benefit of the regulations is a reduction in the amount of property damage, the number of injuries, and the number of lives lost as a result of fires and explosions of gasoline on boats.

Effective date: These rules are effective on August 1, 1977.

AUTHORITY: This rule is adopted under authority of the Federal Boat Safety Act of 1971 (46 U.S.C. 1454). The authority vested in the Secretary of Department of Transportation by the Act is delegated to the Commandant of the Coast Guard at 49 CFR 1.46(n)(1).

Accordingly, with these changes and additions, Part 183 of Chapter 1 of Title 33 of the Code of Federal Regulations is amended by adding a new Subpart J to read as set forth below.

I have determined that this document does not contain a major proposal requiring preparation of an Inflationary Impact Statement under Executive order 11821 and OMB Circular A-107.

Dated: January 25, 1977.

O. W. SILER,
Admiral, U.S. Coast Guard
Commandant.

Subpart J—Fuel Systems

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AUTHORITY: 46 U.S.C. 1454; 49 CFR 1.46 (n)(1).

Subpart J—Fuel Systems

GENERAL

§ 183.501 Applicability.

(a) This subpart applies to all boats that have gasoline engines, except outboard engines, for electrical generation or mechanical power for propulsion.

(b) The sections in this subpart are effective on the following dates:

AUGUST 1, 1977

183.501	183.562
183.505	183.566
183.507	183.568
183.518	183.572
183.520	183.580
183.528	183.582
183.534	183.584
183.536	183.586
183.538	183.588
183.542	183.590
183.556	

FEBRUARY 1, 1978

183.510	183.550
183.514	183.554
183.522	183.560
183.530	183.564
183.532	183.570

AUGUST 1, 1978

183.512	183.540
183.516	183.552
183.524	183.558
183.526	

§ 183.505 Definitions.

As used in this subpart—

"ASTM" means American Society for Testing and Materials. ASTM standards in this subpart may be examined at Coast Guard Headquarters, Room 4314, Trans Point Building, 2100 2nd St., S.W., Washington, D.C. 20590 and may be obtained from the American Society for Testing and Materials, 1916 Race Street, Philadelphia, PA 19103.

"Flame arrestor" means a device or assembly that prevents passage of flame through a fuel vent.

"Fuel system" means the entire assembly of the fuel fill, vent, tank, and distribution components, including pumps, valves, strainers, carburetors, and filters.

"Military Specification" means a specification developed by the U.S. Armed Forces. Military Specifications in this subpart may be examined at Coast Guard Headquarters, room 4314, Trans Point Building, 2100 2nd St., S.W. Washington, D.C. 20590 and may be obtained from the Commander, Naval Ship Engineering Center, DOD Standardization Program & Documents Branch, Hyattsville, Maryland 20782.

"SAE" means Society of Automotive Engineers, Inc. SAE standards in this subpart may be examined at Coast Guard Headquarters, Room 4314, Trans Point Building, 2100 2nd St., S.W., Washington, D.C. 20590 and may be obtained from the Society of Automotive Engineers, Inc., 400 Commonwealth Dr., Warrendale, PA 15096.

"Static floating position" means the attitude in which a boat floats in calm water, with each fuel tank filled to its rated capacity, but with no person or item of portable equipment on board.

"UL" means Underwriters' Laboratories, Inc. UL standards in this subpart may be examined at Coast Guard Headquarters, Room 4314, Trans Point Building, 2100 2nd St., S.W., Washington, D.C. 20590 and may be obtained from Underwriters' Laboratories, Inc., 207 East Ohio Street, Chicago, IL. 60611.

"USCG Type A Hose" means hose that meets the performance requirements of—

(1) SAE Standard J30C, dated March, 1976 and the requirements of § 183.590; or

(2) UL Standard 1114 dated September 15, 1976.

"USCG Type B Hose" means hose that meets the performance requirements of SAE Standard J30C, dated March, 1976.

§ 183.507 General.

Each fuel system component on a boat to which this subpart applies must meet the requirements of this subpart unless the component is part of an outboard engine or is part of portable equipment.

EQUIPMENT STANDARDS

§ 183.510 Fuel tanks.

(a) Each fuel tank in a boat must have been tested by its manufacturer under § 183.580 and not leak.

(b) Each fuel tank must not leak if subjected to the fire test under § 183.590. Leakage is determined by the static pressure test under § 183.580, except that the test pressure must be at least one-fourth PSIG.

(c) Each fuel tank of less than 25 gallons capacity must not leak if tested under § 183.584.

(d) Each fuel tank with a capacity of 25 to 99 gallons must not leak if tested under § 183.586.

(e) Each fuel tank of 100 gallons capacity or more must not leak if tested under §§ 183.586 and 183.588.

§ 183.512 Fuel tanks: prohibited materials.

(a) A fuel tank must not be constructd from terneplate.

(b) Unless it has an inorganic sacrificial galvanic coating on the inside and outside of the tank, a fuel tank must not be constructed from black iron or carbon steel.

(c) A fuel tank encased in cellular plastic or in fiber reinforced plastic must not be constructed from a ferrous alloy.

§ 183.514 Fuel tanks: labels.

(a) Each fuel tank must have a label that meets the requirements of paragraphs (b) through (d) of this section.

(b) Each label required by paragraph (a) of this section must contain the following information:

(1) Fuel tank manufacturer's name (or logo) and address.

(2) Month (or lot number) and year of manufacture.

(3) Capacity in U.S. gallons.

(4) Material of construction.

(5) The pressure the tank is designed to withstand without leaking.

(6) Model number, if applicable.

(7) The statement, "This tank has been tested under 33 CFR 183.580."

(8) If the tank is tested under § 183.584 at less than 25g vertical accelerations the statement, "Must be installed aft of the boat's half length."

(c) Each letter and each number on a label must—

(1) Be at least $\frac{1}{8}$ inch high and

(2) Contrast with the basic color of the label or be embossed on the label.

(d) Each label must—

(1) Withstand the combined effects of exposure to water, oil, salt spray, direct sun light, heat, cold, and wear expected in normal operation of the boat, without loss of legibility; and

(2) Resist efforts to remove or alter the information on the label without leaving some obvious sign of such efforts.

§ 183.516 Cellular plastic used to encase fuel tanks.

(a) Cellular plastic used to encase metallic fuel tanks must—

(1) Not change volume by more than five percent or dissolve after being immersed in any of the following liquids for 24 hours at 29° C:

(i) Reference fuel B ASTM D-471, dated December 18, 1968.

(ii) No. 2 reference oil of ASTM D-471, dated December 18, 1968.

(iii) Five percent solution of trisodium phosphate in water; and

(2) Not absorb more than 0.12 pound of water per square foot of cut surface, measured under Military Specification MIL P-21929B, dated June 22, 1970.

(b) Non-polyurethane cellular plastic used to encase fuel tanks must have a compressive strength of at least 60 pounds per square inch at ten percent deflection measured under ASTM D-1621, "Compressive Strength of Rigid Cellular Plastics", dated August 31, 1964.

(c) Polyurethane cellular plastic used to encase fuel tanks must have a density of at least 3.2 pounds per cubic foot, measured under ASTM D-1622, "Apparent Density of Rigid Cellular Plastics", dated September 30, 1963.

§ 183.518 Fuel tank opening.

Each opening into the fuel tank must be at or above the topmost surface of the tank.

§ 183.520 Fuel tank systems.

(a) Each fuel tank must have a vent system that prevents pressure in the tank from exceeding 80 percent of the pressure marked on the tank label under § 183.514(b)(5).

(b) Each vent must—

(1) Have a flame arrester that can be cleaned unless the vent is itself a flame arrestor; and

(2) Not allow a fuel overflow at the rate of up to two gallons per minute to enter the boat.

§ 183.522 Fuel tank fill systems.

Fuel must not blow back through the fuel fitting when a tank is—

(a) Between one-fourth and three-fourths full; and

(b) Refueled at a rate of at least nine gallons per minute.

§ 183.524 Fuel pumps.

(a) Each diaphragm pump must not leak fuel from the pump if the primary diaphragm fails.

(b) Each electrically operated fuel pump must not operate except when the engine is operating or when the engine is started.

(c) If tested under § 183.590, a fuel pump must not leak fuel.

§ 183.526 Carburetors.

(a) If tested under § 183.590, a carburetor must meet the requirements of paragraph (b) of this section.

(b) Each carburetor must not leak more than five cubic centimeters of fuel in 30 seconds when—

(1) The float valve is open;

(2) The carburetor is at half throttle; and

(3) The engine is cranked without starting; or

(4) The fuel pump is delivering the maximum pressure specified by its manufacturer.

(c) Each updraft and horizontal draft carburetor must have a device that—

(1) Collects and holds fuel that flows out of the carburetor venturi section toward the air intake;

(2) Prevents collected fuel from being carried out of the carburetor assembly by the shock wave of a backfire or by reverse air flow; and

(3) Returns collected fuel to the engine induction system after the engine starts.

§ 183.528 Fuel stop valves.

(a) Each electrically operated fuel stop valve in a fuel line between the fuel tank and the engine must—

(1) Open electrically only when the ignition switch is on; and

(2) Operate manually.

(b) If tested under § 183.590, a fuel stop valve must not leak fuel.

§ 183.530 Spud, pipe, and hose fitting configuration.

Except when used for a tank fill line, each spud, pipe, or hose fitting used with hose clamps must have—

(a) A bead;

(b) A flare; or

(c) A series of annular grooves or serrations no less than 0.015 inches deep, except a continuous helical thread, knurl, or groove.

§ 183.532 Clips, straps, and hose clamps.

(a) Each clip, strap, and hose clamp must—

(1) Be made from a corrosion resistant material; and

(2) Not cut or abrade the fuel line.

(b) When tested under § 183.590, a clip, strap, or hose clamp must not separate under a one pound tensile force.

(c) The minimum nominal band width of a hose clamp is determined under Table 7 by the outside diameter of the hose.

TABLE 7

Outside hose diameter (inches):	*Minimum nominal clamp band width (inches)*
Less than 7/16	1/4
7/16 to 7/8	7/16
Greater than 7/8 to 1 1/8	3/8
Greater than 1 1/8	1/2

§ 183.534 Fuel filters and strainers.

When tested under § 183.590, each fuel filter and strainer must not leak fuel from the filter, strainer, or its connections.

§ 183.536 Seals and gaskets in fuel filters and strainers.

(a) Each gasket and seal used in a fuel filter and strainer must form an unsplit ring.

(b) Each gasket and each sealed joint in a fuel filter and strainer must not leak when subjected for 24 hours to a gasoline that has at least a 50 percent aromatic content at the test pressure determined under § 183.582(a).

§ 183.538 Metallic fuel line materials.

Each metallic fuel line connecting the fuel tank with the fuel inlet connection on the engine must—

(a) be made of seamless annealed copper, nickel copper, or copper-nickel; and

(b) except for corrugated flexible fuel line, have a minimum wall thickness of 0.029 inches.

§ 183.540 Hoses: identification.

(a) Each "USCG Type A" hose and each "USCG Type B" hose must be identified by the manufacturer by a marking on the hose itself. If the complete text of the marking is not on a section of hose, the boat manufacturer must attach a tag that meets the requirements of paragraphs (b) and (c) of this section.

(b) Each marking and tag must contain the following information in English:

(1) The statement "USCG TYPE (insert A or B) HOSE."

(2) The year in which the hose was manufactured.

(3) The manufacturer's name or registered trademark.

(c) Each character must be block capital letters and numerals that are at least one-eighth inch high.

(d) Each marking must be permanent, legible, and on the outside of the hose at intervals of 12 inches or less.

§ 183.542 Fuel systems.

Each fuel system in a boat must have been tested under § 183.582 by the boat manufacturer and not leak.

MANUFACTURER REQUIREMENTS

§ 183.550 Fuel tanks: installation.

(a) Each fuel tank must not be integral with any boat structure or mounted on an engine.

(b) Each fuel tank must not move at the mounting surface more than one-fourth inch in any direction.

(c) Each fuel tank must not support a deck, bulkhead, or other structural component.

(d) Water must drain from the surface of each metallic fuel tank when the boat is in its static floating position.

(e) Each fuel tank support, chock, or strap that is not integral with a metallic fuel tank must be insulated from the tank surface by a nonmoisture absorbing material.

(f) Cellular plastic must not be the sole support for a metallic fuel tank.

(g) If cellular plastic is the sole support of a non-metallic fuel tank, the cellular plastic must meet the requirements of § 183.516 (b) or (c)

(h) Each fuel tank labeled under § 183.514(b)(8) for installation aft of the boat's half length must be installed with its center of gravity aft of the boat's half length.

§ 183.552 Plastic encased fuel tanks: installation.

(a) Each fuel tank encased in cellular plastic foam or in fiber reinforced plastic must have the connections, fittings, and labels accessible for inspection and maintenance.

(b) If a metallic fuel tank is encased in cellular plastic or in fiber reinforced plastic, water must not collect between the plastic and the surface of the tank or be held against the tank by capillary action.

(c) If the plastic is bonded to the surface of a metallic fuel tank, the adhesive strength of the metal to the plastic bond must exceed the cohesive strength of the plastic.

§ 183.554 Fittings, joints, and connections.

Each fuel system fitting, joint, and connection must be arranged so that it can be reached for inspection, removal, or maintenance without removal of permanent boat structure.

§ 183.556 Plugs and fittings.

(a) A fuel system must not have a fitting for draining fuel.

(b) A plug used to service the fuel filter or strainer must have a tapered pipe-thread or be a screw type fitted with a locking device other than a split lock washer.

§ 183.558 Hoses and connections.

(a) Each hose between the fuel pump and the carburetor must be "USCG Type A" hose.

(b) Each hose used for a vent line or fill line and each hose from the fuel tank to the fuel inlet connection on the engine must be—

(1) "USCG Type A" hose; or

(2) "USCG Type A" or "USCG Type B" hose, if no more than five ounces of fuel is discharged in 2½ minutes when—

(i) The hose is severed at the point where maximum drainage of fuel would occur,

(ii) The boat is in its static floating position, and

(iii) The fuel system is filled to the capacity marked on the tank label under § 183.514(b)(5).

(c) Each hose must be secured by—

(1) A swaged sleeve;

(2) A sleeve and threaded insert; or

(3) A hose clamp.

(d) The inside diameter of a hose must not exceed the actual minor outside diameter of the connecting spud, pipe, or fitting by more than the distance shown in Table 8.

TABLE 8

If minor outside diameter of the connecting spud, pipe, or fitting is—	The inside diameter of the hose must not exceed the minor outside diameter of the connecting spud, pipe, or hose fitting by more than the following distance:
Less than 3/8 in.	0.020 in.
3/8 in. to 1 in.	0.035 in.
Greater than 1 in.	0.065 in.

§ 183.560 Hose clamps: installation.

Each hose clamp on a hose from the fuel tank to the fuel inlet connection on the engine, a hose between the fuel pump and the carburetor, or a vent line must—

(a) Be used with hose designed for clamps;

(b) Be at least one clamp width from the hose end;

(c) Be beyond the bead, flare, or over the serrations of the mating spud, pipe, or hose fitting; and

(d) Not depend solely on the spring tension of the clamp for compressive force.

§ 183.562 Metallic fuel lines.

(a) Each metallic fuel line that is mounted to the boat structure must be connected to the engine by a flexible fuel line.

(b) Each metallic fuel line must be attached to the boat's structure within four inches of its connection to a flexible fuel line.

§ 183.564 Fuel tank fill system.

(a) Each fuel fill opening must be located so that a gasoline overflow of up to five gallons per minute for at least five seconds will not enter the boat when the boat is in its static floating position.

(b) Each hose in the tank fill system must be secured to a pipe, spud, or hose fitting by—

(1) A swaged sleeve;

(2) A sleeve and threaded insert; or

(3) Two adjacent metallic hose clamps that do not depend solely on the spring tension of the clamps for compressive force.

(c) Each hose clamp in the tank fill system must be used with a hose designed for clamps.

(d) Hose clamps used in the tank fill system must—

(1) Have a minimum nominal band width of at least one-half inch; and

(2) Be over the hose and the spud, pipe, or hose fitting and not less than one-half inch from the end of the hose.

§ 183.566 Fuel pumps: placement.

Each fuel pump must be on the engine it serves or within 12 inches of the en-

gine, unless it is a fuel pump used to transfer fuel between tanks.

§ 183.568 Anti-siphon protection.

Each fuel line from the fuel tank to the fuel inlet connection on the carburetor must—

(a) Be above the level of the tank top; or

(b) Have an anti-siphon device or an electrically operated fuel stop valve—

(i) at the tank withdrawal fitting; or

(ii) installed so the line from the fuel tank is above the top of the tank.

§ 183.570 Fuel filters and strainers: installation.

Each fuel filter and strainer must be supported on the engine or boat structure independent from its fuel line connections, unless the fuel filter or strainer is inside a fuel tank.

§ 183.572 Grounding.

Each metallic component of the fuel fill system and fuel tank which is in contact with fuel must be statically grounded so that the resistance between the ground and each metallic component of the fuel fill system and fuel tank is less than 100 ohms.

TESTS

§ 183.580 Static pressure test for fuel tanks.

A fuel tank is tested by performing the following procedures in the following order:

(a) Fill the tank with air or inert gas to the pressure marked on the tank label under § 183.514(b)(5). The pressure is measured by a calibrated pressure gauge with a pressure range not exceeding three times the test pressure required by this paragraph or by a manometer.

(b) Examine each tank fitting and seam for leaks using a leak detection method other than the pressure drop method.

§ 183.582 Static pressure test for fuel systems.

A fuel system is tested by performing the following procedures in the following order:

(a) Fill the portion of the system that is between the fuel line connection at the carburetor and the fill and vent fitting on the boat with air or inert gas to the greater of the following pressures:

(1) Three PSIG.

(2) One and one-half times the pressure created at the lowest point in the fuel system when the fill or vent line, whichever is lower in height, is filled to its top with fuel.

(b) Read the pressure. The pressure is measured by a calibrated pressure gauge with a pressure range not exceeding three times the test pressure required by this paragraph or by a manometer.

(c) Wait at least five minutes and thereafter wait one additional minute for each 10 gallon increment, or fraction thereof, in the tank's capacity greater than 50 gallons.

(d) Read the pressure in accordance with paragraph (b) of this section. A pressure drop measured at the end of the time required by paragraph (c) of this section is due to leakage.

(e) If no pressure drop is measured by the manometer or pressure gauge, then while the system remains pressurized, examine each fuel fitting, joint, and connection except each connection at fill and vent fittings for leaks, using a leak detection method other than the pressure drop method.

§ 183.584 Shock test.

A fuel tank is tested by performing the following procedures in the following order:

(a) Perform the static pressure test under § 183.580.

(b) If the tank is non-metallic, fill it to capacity with a gasoline that has at least a 50 percent aromatic content. Keep the fuel in the tank at 21° C or higher for 30 days prior to testing.

(c) Mount the tank to the platform of an impact test machine.

(d) Fill the tank to capacity with water.

(e) Apply one of the following accelerations within three inches of the center of the horizontal mounting surface of the tank. The duration of each vertical acceleration pulse is measured at the base of the shock envelope.

(1) If the tank is not labeled under § 183.514(b)(8) for installation aft of the half length of the boat, apply 1000 cycles of 25g vertical accelerations at a rate of 80 cycles or less per minute. The duration of the acceleration pulse must be between six and 14 milliseconds.

(2) If the tank is manufactured for installation with its center of gravity aft of the half length of the boat, apply 1000 cycles of 15g vertical accelerations at a rate of 80 cycles or less per minute. The duration of the shock pulse must be between six and 14 milliseconds.

(f) Perform the static pressure test under § 183.580.

§ 183.586 Pressure impulse test.

A fuel tank is tested by performing the following procedures in the following order:

(a) Perform the static pressure test under § 183.580.

(b) If the tank is non-metallic, fill it to capacity with a gasoline that has at least a 50 percent aromatic content. Keep the fuel in the tank at 21° C or higher for 30 days prior to testing.

(c) Mount the tank on a test platform.

(d) Fill the tank to capacity with water.

(e) Cap and seal each opening in the tank.

(f) Apply 25,000 cycles of pressure impulse at the rate of no more than 15 impulses per minute varying from zero to three PSIG to zero inside the tank top from a regulated source of air, inert gas, or water.

(g) Perform the static pressure test under § 183.580.

§ 183.588 Slosh test.

A fuel tank is tested by performing the following procedures in the following order:

(a) Perform the static pressure test under § 183.580.

(b) Perform the pressure impulse test under § 183.586.

(c) Secure the tank to the platform of a tank rocker assembly.

(d) Fill the tank to one-half capacity with water.

(e) Cap and seal each opening in the tank.

(f) Apply 500,000 cycles of rocking motion 15 degrees to each side of the tank centerline at the rate of 15 to 20 cycles a minute. The axis of rotation of the rocker and fuel tank must be perpendicular to the centerline of the tank length at a level six inches or less above or below the tank's bottom.

(g) Perform the static pressure test under § 183.580.

§ 183.590 Fire test.

(a) A piece of equipment is tested under the following conditions and procedures:

(1) Fuel stop valves, "USCG Type A" hoses, clips, straps, and hose clamps are tested in a fire chamber.

(2) Fuel filters, strainers, pumps, and carburetors are tested in a fire chamber or as installed on the engine.

(3) Fuel tanks must be tested filled with fuel to one-fourth the capacity marked on the tank in a fire chamber or in an actual or simulated hull section.

(b) Each fire test is conducted with free burning heptane and the component must be subjected to a flame for 2½ minutes.

(c) If the component is tested in a fire chamber—

(1) The temperature within one inch of the component must be at least 648°C sometime during the 2½ minute test;

(2) The surface of the heptane must be eight to 10 inches below the component being tested; and

(3) The heptane must be in a container that is large enough to permit the perimeter of the top surface of the heptane to extend beyond the vertical projection of the perimeter of the component being tested.

(d) If the component is being tested as installed on an engine, heptane sufficient to burn 2½ minutes must be poured over the component and allowed to run into a flat bottomed pan under the engine. The pan must be large enough to permit the perimeter of the top surface of the heptane to extend beyond the vertical projection of the perimeter of the engine.

(e) If a fuel tank is being tested in an actual or simulated hull section, the actual or simulated hull section must be of sufficient size to contain enough heptane to burn for 2½ minutes in a place adjacent to the tank.

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